PAPERS

IN

MECHANICKS.

Mr. Mathew Hill's Machine for measuring Angles.

MECHANICKS.

A Bounty of FIVE GUINEAS was voted to Mr MATTHEW HILL of Scarborough, for his invention of a Machine for measuring Angles, of which the following Letter contains a Description, with References to the annexed Plate. The Machine being reserved in the Society's Repository for the inspection of the Publick.

S I R,

YOU will herewith receive a Triangular Model, and a Diagram of it; being an Apparatus which I trust will be found useful in solving trigonometrical

questions;

queſtions; and I hope will prove not un-
worthy the notice and adoption of the
Mathematical Inſtrument Maker, for the
uſe of Schools and ordinary Seamen, in
ſolving queſtions in Navigation.

A demonſtration of the uſe of the Tri-
angle, applied in plain ſailing; Suppoſe
either from a Book or Chart, the courſe
and diſtance are known, but the wind not
anſwering to ſail upon that point, yet
keeping as near to it as I am permitted,
after having run ſome time on my courſe,
I am deſirous to know my direct courſe
and diſtance to the Port, they may im-
mediately be had from the Triangle, by ſet-
ting the fixt leg A B, plate 1. to point out
the given courſe and diſtance; and C E,
the courſe and diſtance ſailed: then ſetting
the diameter of the braſs ſemicircle pa-
ralel to the courſe ſailed, its index will
ſhew how many points the courſe to the
Port,

Port, differs from the courfe failed. When
F D, is fixt with its pin in· the diftance
of the defired Port, then alfo is fhewn
the courfe and diftance thereto.

Firft inftance. From Flamborough Head
to the Texel is, in Difton's Seaman's Guide,
S E by E. one hundred and feventy-fix
miles; fuppofe the courfe made good, to
be E, one hundred miles: Having fet the
diameter of the femicircle parallel to C E,
then will F D, when extended to the
intended Port, cut two and one quarter
points for the courfe, and one hundred
and eight miles the diftance. Hence the
ufe of the plain Triangle evidently ap-
pears in all cafes of plain and oblique fail-
ing; confequently better than the finecal
Quadrant, being as applicable to right
angled cafes as that is.

Second

Second Inftance. The difference of latitude and departure for a N N E courfe, one hundred miles diftance being required; fet A B, to the north, E C, with diftance failed to the N N E, then D F, fet to cut A B, at right angles, folves the queftion; that is, on A B, is the difference of latitude, and departure on D F.

TwENTY

TWENTY GUINEAS were voted to
Mr JOSEPH RIDLEY for his improv-
ed SECTOR and TOOL for fetting
Wheels and Pinions in Watch Work,
&c. of which a particular Defcription
is hereafter given, with Plates of the
Inftruments, and for the further in-
formation of Artifts, to whofe ufes
fuch Tools are particularly adapted.
The Inftruments themfelves are referv-
ed in the Society's Collection, for the
infpection of the Publick.

DES-

D E S C R I P T I O N

O F   T H E

SECTOR   DEPTHENING   TOOL

For Wheels and Pinions of Watches, &c. invented by MR JOSEPH RIDLEY.

See Plate 2.

A B and D, are at exact diſtances from the joint or center Pin I.—A and B are fixed, and the outſides of them are to be applied to the inſide of the legs of the Sector, to take the ſemidiameter of Wheels and Pinions when added together. D, is a point moving on a center

G,

Plate II.
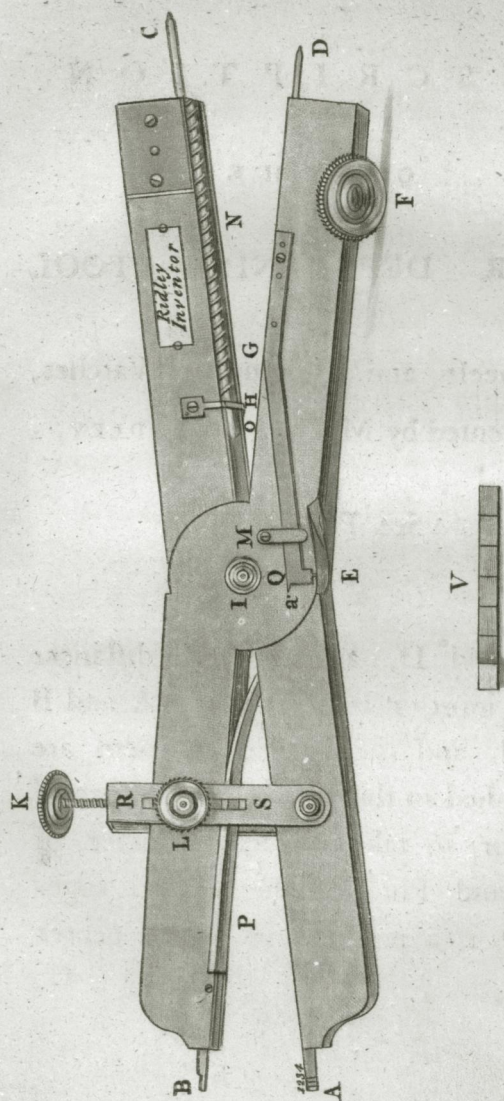
Mr. Ridley's Sector Depthening Tool.

G, and pufhed in or out by the micrometer Screw F; and the tooth E, being at an equal diftance from the point D, when the point Q comes to the dot a D, C, and A, B, ftand at equal diftances from each other. By winding up the micrometer fcrew F, the point D, bears in ; and the tooth E, is thrown out as far as the workman would have the Pinion take into the Wheel : then by putting the tooth of the Wheel againft the Brafs, under the tooth E, the depth may be fetas is thought proper. C, a cylinder, with a point at the extremity, that pumps up through a hole in H, directing to the center I, being a direct line from the point of the cylinder C, acrofs the center pin I, to the outer part of A. When the inftrument is ufed, it muft be held in fuch manner, that the point A, is perpendicular to the point C. H, a piece of fteel fixed on the brafs leg, with a hole

through

through it to direct the end of the cy-
linder C, to the center pin I. N, a Worm-
fpring on the cylinder C, within the brafs
leg. At O, the end of the point D, is
formed into a ftrong fpring, lying within
the brafs leg, to keep D bearing againft,
and depending on the direction of the
micrometer fcrew F. E, a tooth : when a
Wheel is placed under this tooth any depth,
chofen, may be had by winding up the
micrometer fcrew F. Q. a point pro-
jecting from a moveable fteel bar: when
this point is exactly on the dot a, and
the cylinder C pumped up, D and C,
will be at the fame diftance from each
other that A and B are. R, a Brace, that
laps on each fide the Inftrument, to give
play to the ftrong fpring P, which being
moved by the micrometer fcrew K, fets
the Inftrument out or in. S, a flit in
the Brace, to receive the fcrew L, by
which the Brace is fixed when the Inftru-
ment

ment is set to any desired place. At
A, are four marks, and it must be ob-
served, that when the outside of A and
B, which go between the legs of the Sec-
tor, expand one quarter of an inch, you
must rise A, as far as one mark above
the surface of the Sector; but the end
B, must at all times come even with the
surface of the Sector. When they ex-
pand two quarters of an inch from each
other, then you must rise A, two marks,
&c.—V, a small Brass Rule an inch
and an half long, divided into quar-
ters of an inch : by setting this Rule to
A, the distance from A, to B, in quar-
ters of an inch is shewn; and as many
quarters of an inch, as appear, so many
marks must·be seen above the surface of
the Sector.

DIRECTIONS FOR USING THE ABOVE INSTRUMENT.

WHEN it is required to find holes for Wheels and Pinions, put the Wheel to its number on the Sector, Plate 3. then try the Pinion; if found to agree for what they are to perform, add the diameter of the Pinion to the number of the Wheel, from which take the femidi-ameter of the two; for example, If the Wheel is 80, and the Pinion 8, added together=88; the half is 44. Then bring the Points A B, of the depthening Tool, plate 2, to 44, between the legs of the Sector; screw up the micrometer screw F, Plate 2, which throws out the tooth E, as far as you would have the Pinion

take

take in the Wheel; at the fame time in-
cline the point D, as far in as the tooth
E, is thrown out; then put the point of
the cylinder C, into the hole you are to
go from. Pump up the cylinder C, to
bring the point D, down, to mark the
place where the next hole is to be drilled,
and holding A, perpendicular to C, make
the mark, and drill it carefully; for
fhould you be ever fo accurate in fetting the
Inftrument, you may by drilling the holes
improperly, utterly defeat the intention.

INSTRUCTIONS FOR MAKING WHEELS AND PINIONS FOR ANY TWO GIVEN HOLES.

Firft, let out the tooth E, Plate 2, a pro-
per depth; the moft certain way is to take
a Wheel, having as near as you can ima-
gine, fuch Teeth as your Wheel will
have when cut; then put the point of the

O   cylin-

cylinder C, into one of the holes you are
providing Wheels, &c. for; pump it up:
when the point D, comes down, wind the
micrometer fcrew K, in the brace, in or
out as required: when the point D,
comes to the center of the hole, apply
the ends of the inftrument A and B, be-
tween the legs of the Sector, at half
the number of teeth you propofe to have
in your Wheel and Pinion, when added
together; for example; if the Wheel
be 80, the Pinion 8, together 88 : half
is 44; bring your Sector carefully to-
gether, fetting A and B, Plate 2. at
44; make faft your Sector, and make
your Wheel to fit at 80, and your Pi-
nion at 8 : When they are cut, put them
in the given holes, and you will find your
Pinion will depthen as far in the tooth
of the Wheel as you have let out the
tooth E, beyond the edge of the brafs.
The Pinion, when a Leader, meafures its

full

full number; but when the Wheel is Leader, it muft be obferved, the Pinion is not to take its full diameter, but only at $7\frac{1}{2}$ at moft, and 7, at the leaft; the Pinion therefore is not to be taken by its number, but by its diameter; for inftance, if a Wheel has 80 teeth, and the Pinion 8, being led by the Wheel, and the diameter according to the Wheel, be but 7 :   add 80 and 7 together, the half of which is $43\frac{1}{2}$. After this manner all allowances muft be made.   In fancy work there are many methods of gauging and cutting Wheels and Pinions; but it muft be obferved, that from the diameter when added together, you are to take the femi-diameters.

This is a true defcription of, and direction for the ufe of my new invented Sector Depthening Tool.

JOSEPH RIDLEY.

April 14, 1788.

D E-

D E S C R I P T I O N

O F T H E

S E C T O R

As improved by Mr Joseph Ridley.

Plate 3.

THE fide of this Sector having the two fcales on the arch, bears it's true meafure from the center pin O, and is ufeful for taking the diametrical part or parts, from fix inches to the niceft point. In order to take the diameter of a fphere or any part of a cone, there are employed two angles of brafs L L, having each holes in the angles 1, 2. with flits in the long parts ; thefe are parallel when in ufe, but are only put on occafionally, and do not

remain

Plate III.

Mr. Ridley's improved Sector.
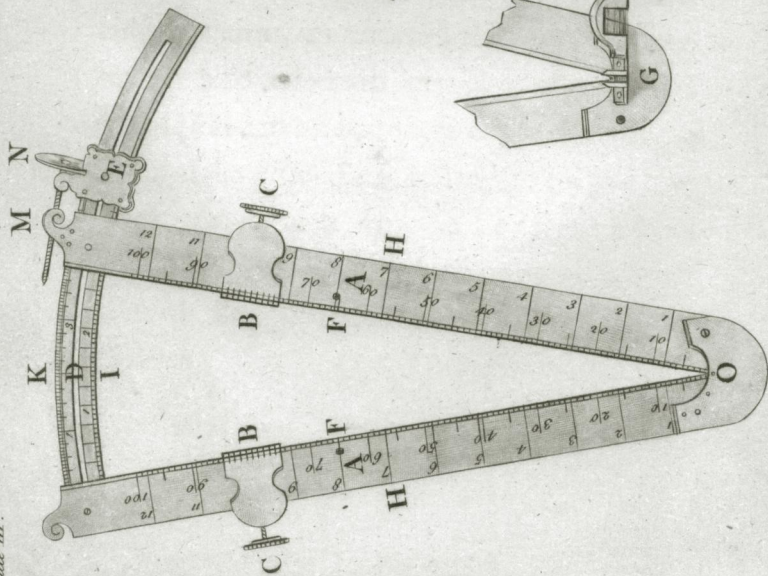
The Screw to go in the hole of one, & the slit of the other,
& screws in the 60. & 70. on the scale F. on the Sector,
not on the wheel & pinion side but is guided by the
lower Scale, never to be on but when required for Spheres &c.

Spring Screws
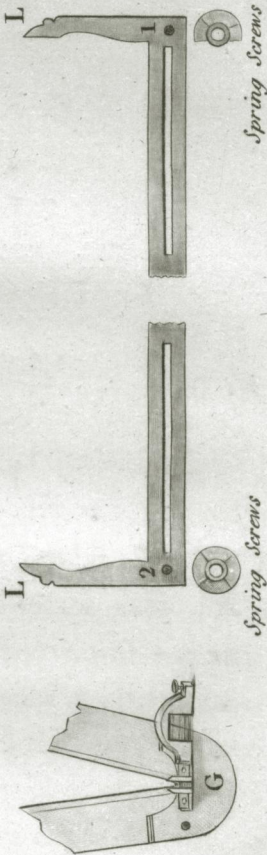
Spring Screws

remain on the Sector. The fpring fcrew is cut away to receive the fcrew for hole 1, that works in hole 2. When you fix on the angles, put the fcrew above mentioned, No 1, in the double angle near the hole; and through the flit of the other, fcrew it in the hole provided between 60 and 70, on the fcale F in the leg that the micrometer works in : put the other fcrew in the flit of No 1, and through the hole of No 2, into the hole in the other leg between the 60 and 70 in F, being juft eight inches from the center pin O, pointing from the fcale H H; the perpendicular parts L L, ftand up towards the arch. And by the under fcale I, on the arch D, being figured into quarters of inches, you may find the true diameter of a fphere or any part of a cone, &c. A A, are the legs of the Sector. B B, the fliders, bearing ten holes each, and moving up and down to any part

of

of the legs to take any diameter required,
with dividers, the holes being directly over
the inner edge of the Sector. C, C, the nuts
and screws to keep the sliders close to
the edge of the Sector when set to any
desired place.   D, the arch bearing two
scales, the upper, marked K, the under,
marked I.   E, the follower, when set fast
by its screw, the micrometer N, work-
ing through M, winds one of the legs of
the Sector in or out in order to set it to
any nice point.   F F, are scales of one hun-
dred eighths of an inch, to make the
taking diameters of Wheels more easy.
H H, are scales of twelve inches, direct-
ing to and dividing the inner scales F F,
into inches.   I, the under scale on the
arch D. for the two angles of brass
L L, when occasion requires them.   K,
the upper scale on the same arch shew-
ing the distance the legs of the Sector
stand at the twelfth inch from the cen-
ter

ter pin at all times. By this fcale you may find diameters with great accuracy. If what you take the diameter or the length of, comes within an inch and an half by the fcale K, then the twelve inches ftand at an inch and an half diftance, being 12 eighths; each inch from the center, being one eighth; and each eighth on the fcale F, being divided into half, divides each eighth into fixteen diftinct parts. By the fcale K, the Sector may be fet to take diameters, lengths, fquares, &c. from the fmalleft point to fix inches, being the number of inches on the fcale K.

DESCRIPTION OF THE WHEEL AND PINION SIDE OF THE SECTOR.

THE fcales F F, on the infide of the Sector, are for Wheels and Pinions only, beginning its numbers two fpaces from

the

the center pin.   B B, the sliders as be-
fore mentioned.   G, two steel chaps to
guage the Cutter proper for cutting any
Wheel prepared for that purpose.   The
Blank Wheel must be put to the number
of the Sector you would have cut.   To
find the size of the Cutter, apply it in
between the top of the chaps G.   If you
desire to have the space and tooth equal,
put your Cutter just half way ; if wider
or narrower, you may judge by putting
the Cutter in or out from the mark in the
middle of the Chaps.   In cutting small
Wheels, Nuts or Pinions, the Cutter
must go in between the Chaps beyond
the mark in the middle.   By the cutting a
Wheel about three quarters of an inch, and
a Pinion of about an eighth, the work-
man may judge how to guage his Cutters,
according to the size or diameter of his
Wheel or Pinion.

<div align="right">The</div>

The wheel and pinion fide of the Sector, will not tell, by the fcale, the femidiameter of a Wheel, for in taking diameters on the Wheel and Pinion fide, the two loft at the bottom muft be carried with the number, fo that 80, is to be called 82 from the center pin, and 8 is to be called 10; then adding 82 to 10, makes 92; the half of which is 46. When there are two diameters to be added together, this fcale tells right, but at no other time without carrying the loft 2 at the bottom.

This is a true defcription of my IMPROVED SECTOR.

JOSEPH RIDLEY.

April 14, 1788.
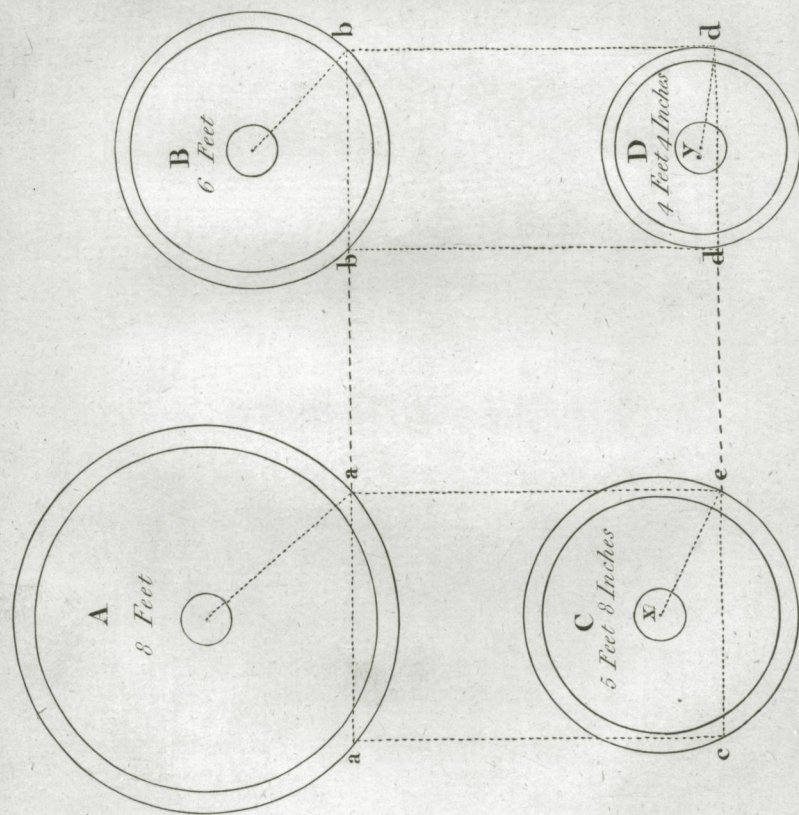
CAR-

C A R R I A G E

FOR CONVEYING

TIMBER, &c. OVER SOFT OR BOGGY LAND.

THE Advantages that would arife if a ready and commodious manner of conveying Timber or other heavy Materials, over foft or clayey Land, at a moderate expenfe was difcovered, are well known to all perfons concerned in felling Timber, or tranfporting Blocks of Stone: And a premium was offered during feveral years, for producing to the Society, a method of accomplifhing the end propofed. This year, a claim was made, and the premium, (TWENTY GUINEAS) adjudged to Mr JOHN BESANT of Mill Bank, Weftminfter, of whofe Carriage a Defcription is annexed; and the Model produced, is referved in the Society's Repofitory, for the infpection and ufe of the Publick.

MR

Mr. Besant's explanation of his Carriage.

Plate IV.

B
6 Feet

D
4 Feet 4 Inches

A
8 Feet

C
5 Feet 8 Inches

MR BESANT's EXPLANATION OF A
CARRIAGE FOR CONVEYING TIM-
BER or other heavy MATERIALS over
SOFT or BOGGY LAND, and of the
PRINCIPLE on which the MODEL is
conftructed.

THE Model of the Carriage, (which
is on a fcale of three inches to a foot)
it is believed will convey a proper idea:
And the following explanation of the ad-
vantages of the high wheels, and troughs
or flids, over common wheels, will, it
is prefumed, give it a decided preference
over other Carriages, not only for the
above purpofe, but for all common ufes;
as this Carriage may be loaded by one
man, and the expenfe of it is not fo much

as

as that of a common Carriage and the Gin which muſt accompany it; for a farmer may go into the wood, cut down two poles, lay them upon the Axis and Wheels, fix them with a chain, and with the affiſtance of two common fawpit rollers, he will form a compleat Carriage.

Let A B, Plate IV. be two wheels; A 8, and B, 6 feet diameter: C and D, two wheels; C, 5 feet 8 inches: D 4 feet 4 inches, being the uſual ſize of Carriage wheels. Admit the weight of an horſe to be 600 lb. the ſuperficial contents of his hoofs, 5×5. 25 inches; it is evident that for a horſe to walk, the denſity of the foil on which he walks muſt be ſufficient to ſupport him on three legs 25 x 3-75 inches, by which divide 600; the quotient gives 8lb. to the inch: the denſity of the foil the horſe requires to ſtand on; then ſuppoſing A and B to be funk twelve inches

ches in the ground, the length a a, of the
furface A, and bb of the furface B, will
be 5 feet 5 inches, and 4 feet 9 inches==
122 inches, which x 2, for the oppofite
wheels 244; which x6 for the breadth of
the felly==1464 inches for the furface the
wheels reft on; this x8, the denfity of
the foil 11712lb. or 5 tons, 4cwts. 2qrs.
8lb. the weight which the wheels would
fupport without finking more than one
foot below the furface, and is equal to
about four load of green Oak, allowing
fixty pound to the fquare foot.

The advantage thefe Wheels have over
the common ones is evident, by infpect-
ing the figure A BCD, as in order to gain
a furface of 1464 inches, the wheels C
and D, muft fink to c c and d d, near two
feet below the furface; by which the le-
verage x c and y d of the fpokes, becomes
fo fmall in the latter as to require a very
great

great addition of force to move the Carriage forward.

Four load, or two hundred feet, is a heavy draft for fix horfes on common roads and Carriages ; but the load being fufpended under the axis, as fhewn by the model, the horfes drawing by the timber inftead of the fhafts, gives a great advantage : the center of gravity being continually urged out of its perpendicular direction by the uniform motion of the horfes, the wheels will of courfe have a continual tendency forwards, in order to recover it.

It is prefumed that this Carriage will carry five tons and a quarter on any ground which will fupport the horfes ; where it is too foft for them to ftand, it will likewife be too foft to fupport the wheels ; in that cafe, the troughs or flids which ac-

com-

company the Carriage, are to be placed under the wheels, which being twenty-four inches wide confequently increafe the furface on which the load will then reft, four times, and the preffure being in an inverfe proportion to the furface, will then be reduced to two pound to the inch; and the foil being fo very foft, the troughs or flids will move eafier than a Carriage would on hard roads: the carriage may then be drawn by means of a rope paf-fing over the fhieve of a notch block, tailed to any neighbouring tree or ftump, and horfes may be placed in any direc-tion, or at any diftance, as the ground will admit them to work on. The method of loading this Carriage, will likewife have the advantage of the common Gin, on foft ground, in proportion to the differ-ence of furface between the four wheels and the three legs of the Gin.

As

As many inconveniencies occur at tim-
ber-carting, it may not be amifs to men-
tion one wherein the new method will
have a great advantage : Suppofe a Car-
riage is loaded and going on, the wheels
fuddenly fink into the foil fo far as for
the load to hang; by the common meth-
od, there is no refource but to get more
horfes and pull it out by main ftrength,
becaufe the Gin will not hoift it on fuch
foft ground :   But by the new method,
it is only neceffary to loofe the leavers and
lower the timber quite to the ground,
draw off the wheels and place the
troughs or flids under them, hoift up
the load, and go on till off the bog.
By the fame mode of reafoning, it may
be fuggefted perhaps, that nine inch
wheels would be preferable; but it fhould
be recollected, that fix inch ones will be
lighter, and therefore better for com-
mon ufe.

DESCRIP-

Plate V.

Fig. 2.

Fig. 3.

Fig. 1.
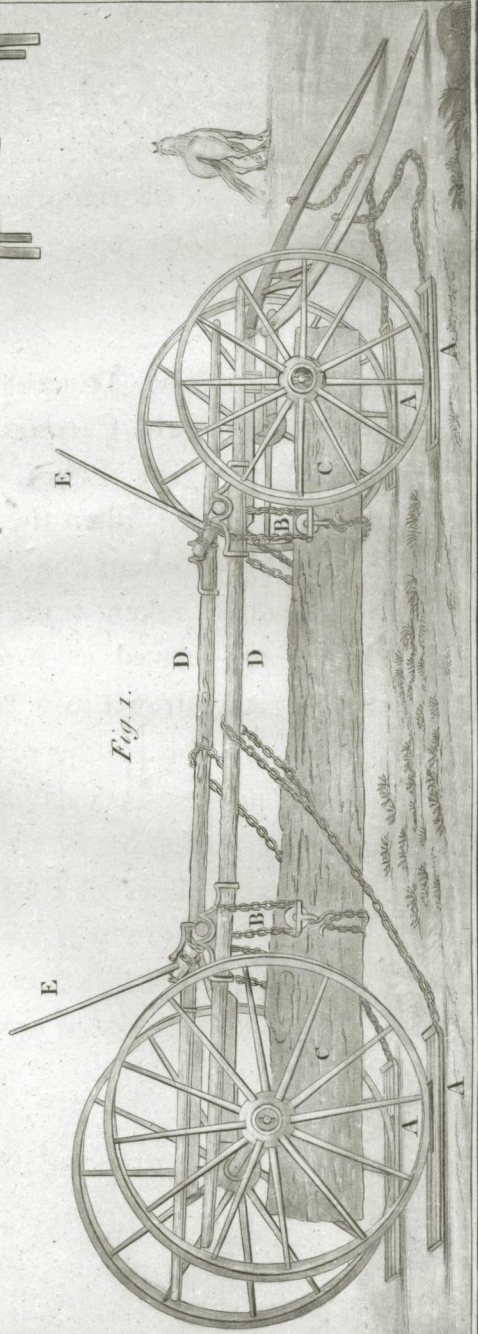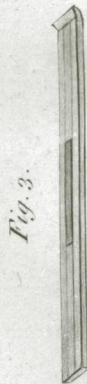
Mr Bevan's Carriage for conveying Timber on soft or boggy Land.

DESCRIPTION OF THE PLATE OF MR
BESANT's MACHINE FOR TRANS-
PORTING TIMBER, OR OTHER HEAVY
MATERIALS OVER SOFT OR CLAYEY
LAND.

A.A.A.A. Plate 5. The Troughs or
Slids which are hung to the Carriage by
Chains, as expreffed in the Plate, and
are occafionally to be ufed when the foil
is too foft to do without them; in fuch
cafe, the Horfe is to be taken from be-
tween the fhafts, and placed at a dif-
tance, and the Carriage drawn by a rope
either in a ftraight line or paffing over a
notch-block, as mentioned in page 207.
B. B. the Chains and Pullies by which the
Timber or other heavy Materials CC, are
fufpended from the Rollers which lie on
the poles D D. E E, Handfpikes in the
eyes or mortiffes of the Rollers, by which
the

the load is raifed or lowered. Thefe Rol-
lers work on Irons placed upon the Poles,
and moveable thereon according to the
diftance required from the nature and
length of the load. The form of thefe
Irons, with the end of a Roller, is fhewn
on a larger fcale at Fig. 2. Plate 5.

Fig. 3. one of the Troughs or Slids,
detached from the Carriage.

REWARDS